Newsletter for February 2023

What’s It Like To Actually Work In Science?

By Zennith | February 26, 2023

Science sounds neat, doesn’t it?

Obviously reality isn’t like what Hollywood shows, but science is still a bit of a mystery for those outside the field.

Most of the scientists I’ve interacted with (even back in college and in graduate school) are more focused on figuring out how to solve some problem. That is to say, I haven’t interacted with many people who can be described as “blue-sky” scientists. Blue-sky scientists are almost mythical to me, because I haven’t seen any evidence they exist!

From what I have seen, there is a broad gradient in scientists’ interests, ranging from discovery-based, to applications/deliverables-focused. Academics tend to be more interested in discovery, and in understanding how natural systems work, but still more often than not have practical goals in mind about how their discoveries will create new ways of solving problems, even if it’s on a longer time horizon.

Personally, I’m a scientist strongly biased towards applications and deliverables. While I do enjoy understanding how natural systems work, it’s often not necessary to fully understand a system before you engineer it. My mindset is that you only have to understand the outer boundaries of a system, to a level where you can predict and control the system’s function.

Now, to be clear, I’m not saying I like working with black boxes. Understanding the general principles at work inside a system helps you predict its output. But even then, my point is that I am motivated by the idea of predicting and controlling the system’s function in useful ways.

The above might sound like a tangent, but I think it’s important for you, the reader, to see my frame of mind, because it will help you understand what I do every day as a scientist.

(And this is quickly getting meta - you’ve now learned the general principles at work in my mind, and thus, I think you’ll better be able to predict (and control?) my output!)

My work schedule is built around the idea of ‘plugging in’ my experiments into a larger research study. I am currently helping out with a clinical trial, and the same principles have been true in other studies I’ve worked on as well. My research is helping determine whether or not a proposed drug is safe and effective for use in patients. More specifically, I am developing a way of quantitatively detecting whether and how a specific biomarker increases/decreases in expression after a drug is given to patients. After the clinical trial, the FDA will use the biomarker data collected from patients when deciding whether or not to approve the drug.

Currently, my week approximately follows this share of time:

- 15% of time preparing for and leading project-focused meetings, presentations, and other communications
- 15-20% of time planning experiments
- 5% of time ordering and organizing supplies
- 40% of time performing wet-lab experiments
- 15-20% of time analyzing and interpreting results, and
- 5% of time on other meetings

Right away, you can see that wet-lab experiments take a (large) minority of the time, and it’s almost matched in time intensity by planning and analyzing experiments.

I don’t spend most of my time in the lab, since a lot of the work is figuring out what is important to test and how to test it, and then figuring out what the results tell you so that you can design your next experiment.

You can also see three important non-scientific things I have to do: communications, logistics, and… communications again. Scientists don’t work in a vacuum, and communications are especially important for this. Some of the most important communications are presenting your results to stakeholders, and especially giving them evidence on how your work is solving relevant problems. The best communications are two-way streets, and can be the most fun part of your project. Your stakeholders are a great resource, and if you manage your meetings the right way, you can get the input and feedback you need while growing the relationship with your stakeholders.

Scientists also have to handle logistical needs. Samples, reagents and chemicals, and even specific consumables like 96-well plates have to be obtained, and have to be stored correctly. Some things have to be stored at -80 C, whereas others can just be stored at -20 C, 4 C, or at room temperature. Some reagents have to be “aliquoted” before freezing, so that you can later melt only an aliquot without needing to re-freeze it. This is because repeated freeze-thaw cycles generally harm reagents and samples. Proteins can denature, and growing ice crystals can rip apart DNA and cell membranes alike. Many logistical steps have to be performed by scientists, because the scientist in question understands how to properly store their supplies in a way that doesn’t harm results later on.

We can now see how these various activities - communication, experimentation, and logistics - fit together into a project that ultimately results in a useful outcome.

Starting with a project kickoff meeting, you discuss with your stakeholders to learn their goals, and make sure that your experiments fit into the bigger picture to ultimately solve a problem. In my current project, the goal is to create a way to reliably, quantitatively detect an important biomarker relevant to disease. A lot is riding on that data, so it is important to develop an assay that doesn’t give false positives or false negatives, and that gives reliable results across tens, hundreds, or even thousands of patients enrolled in the clinical trial.

It’s up to you to distill those goals into a series of experiments you can perform. Figuring out how to create a detection method that is specific for the biomarker and no other molecules in the patient sample, and that is quantitative in absolute terms, because the specific quantity of that biomarker is crucial for understanding how well the drug is working. Many of the requisite decisions are made with active communication among your stakeholders and co-workers, but it is ultimately up to you to make the final call on what steps are scientifically necessary.

With those plans in hand, you then generally proceed in a cycle of: (1) naming or identifying different possibilities, where it is important to determine which possibility is true, (2) planning a specific experiment to determine which of those possibilities is true, and what good “controls” are to verify that your interpretation isn’t misled by an artifact, (3) executing the wet-lab work by manipulating samples and reagents in various ways, (4) using detection equipment to see what happened to the samples of interest (often by detecting an artificial color or fluorescent tag that tracks what the underlying biological system did), (5) getting the data off your detection equipment and putting it into software (sometimes just literally Excel), (6) comparing the results against what you expected, and finally (7) figuring out where to go next before looping back to (1). These loops can be rapid - taking only 1 or 2 days in my case, which means decision-making can be pretty fast.

From time to time, you have update meetings/presentations, get more two-way dialog, and repeat until you've achieved project goals and can help integrate your work with the larger goal of improving patient health.

And that's basically it! Being a scientist definitely involves a lot of running experiments, but as you can see, there are a lot of other activities that go on as well. It's also interesting because a few years ago, while I was still in training in graduate school, I had the impression that science went at a much slower pace. It's very rewarding to see your work have such a rapid impact on useful outcomes.

That's all from me for now. Thanks so much for reading!

Compliance Update

By Zennith | February 26, 2023

The charitable solicitation renewals season is upon us

This newsletter issue is admittedly lighter on content than the January one! We'll have another research update next month.

While we wait on that, it's a good time to give an update on where we stand in terms of regulatory compliance. Compliance is especially important for charities, because it's how regulators ensure that organizations aren't funneling money anywhere or taking advantage of people's generosity.

There are some interesting details here. For example, did you know that for-profit companies cannot advertise they will donate some amount of profits to a charity, unless they have a legally binding contract with that charity? Those are called commercial co-ventures. While we don't have any commercial co-venture partnerships, there's other layers of compliance that we are responsible for.

Most states in the US have rules about how fundraising is performed. It varies a lot from state to state. Some states are very strict. For these states, simply having a presence on the internet where you ask for donations is sufficient to activate a requirement where you have to register with a state regulator. On the other end of the spectrum, for example, is Texas, where (for better or worse) we don't have any need to register with them at all.

Compliance can get complicated quickly when you're managing relationships with tens of state authorities, along with the IRS as well as our home state, Massachusetts. Within any given state, you often have to file to both their Attorney General and their Secretary of State.

This year's main charitable solicitation renewals season will run from March through the middle of May (for organizations with financial years synchronized with the calendar year), and we're in good shape to get through the paperwork efficiently.

The hardest part is getting the financial information together in the first place, and slicing it in the ways that regulators care about. First, regulators want to ensure money is being spent responsibly and ethically, and especially want to check that there are no inurement activities. In other contexts, regulators (especially the IRS) want to check expenses you paid towards employees or payroll taxes against information filed in forms 941. And as one last example, regulators want to check how you are earning your revenues - are they simply by donations or fundraising events, or are they through, say, service or product revenues, or even gaming/gambling activities?

We're just about done with the hard part, and this compliance renewals season should be in good shape.

Most state authorities ask for very similar information, around the same time of year, and it’s very efficient to do several filings as a batch with all the information at your fingertips. Our filings are now neatly organized by state, state authority, and filing year, and we’ve got a spreadsheet that keeps track of dates, registration numbers, and a summary of previous filings with any given authority. Hands-on time is now down to about 30 to 60 minutes per state per year. Not bad. Not bad at all!

Looking back, I’m glad we got help from contractors in our first few years, especially in 2018 and 2019, because we didn’t sufficiently understand how these systems worked. But, after a few years of learning the ropes, we’ve got things running quite efficiently. Compliance still isn’t exactly fun, but it serves an important purpose, and we’re happy to do our part to make sure charities uphold the trust placed in them.

Volunteer Spotlight: Moonbeam

By Moonbeam | February 28, 2023

Hello! I'm Moonbeam, one of our longest-serving volunteers here for a brief re-introduction. Most of you already know me as the community manager and the provider of interviews for the FFF server. I also serve on our board of directors, where I help decide policies and improve communication as a non-biological scientist.

I earned my bachelor's degree in psychology in December 2022, and am currently working as an intern for a large media company. Some of my interests in addition to freedom of form include healthy intrapersonal multiplicity, gender and sexuality, and the interaction between psychology and wider social trends.

I have many years of experience as a community moderator and leader on various Discord servers, and have used that experience to help the FFF's server be the best it can. Send me a DM if you have any suggestions for the server!